Estimates of Global and Regional Smoking Prevalence in 1995, by Age and Sex

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Objectives. We calculated regional and sex- and age-specific smoking prevalence estimates worldwide in 1995.

Methods. Sex-specific smoking prevalence data from studies in 139 countries and age distribution data from 7 studies were analyzed.

Results. Globally, 29% of persons aged 15 years or older were regular smokers in 1995. Four fifths of the world's 1.1 billion smokers lived in low- or middle-income countries. East Asian countries accounted for a disproportionately high percentage (38%) of the world's smokers. Males accounted for four fifths of all smokers, and prevalence among males and females was highest among those aged 30 to 49 years (34%).

Conclusions. Future decades will see dramatic increases in tobacco-attributable deaths in low- and middle-income regions. Although much of this excess mortality can be prevented if smokers stop smoking, quitting remains rare in low- and middle-income countries. (*Am J Public Health.* 2002;92:1002–1006)

It is estimated that 4 million deaths from tobacco occurred in 1999 and that the annual number of deaths is likely to rise to 10 million by the 2030s.[1] Quantification of smoking's current and future effect on global disease burden relies on local retrospective and prospective epidemiological studies[2–4] or indirect estimates.[5] Ideally, such studies would be supported by reliable estimates of smoking prevalence, incidence, and cessation rates. Such smoking statistics help to monitor age- and sex-specific trends and the success of control programs.

From the perspective of global tobacco control, global or regional estimates are similarly useful. In 1997, the World Health Organization[6] (WHO) calculated and published global prevalence rates of smoking. Much of the data in that review relied on smoking prevalence data from the late 1980s or earlier.

We estimated the sex- and age-specific prevalence of tobacco smoking globally and regionally for 1995. These values were used in a subsequent analysis to assess the cost-effectiveness of tobacco control policies.[7] This article relies chiefly on smoking prevalence data from 109 countries collected as part of the Tobacco Control Country Profiles[8,9] as well as earlier data from WHO[6] and the literature. We used World Bank definitions of regions, whereas WHO definitions of regions were used in the Tobacco Control Country Profiles. We excluded some of the Tobacco Control Country Profiles studies because the literature or the 1997 WHO publication (itself based on earlier surveys conducted around 1990) provided more recent estimates. 1998 was chosen as the base year for the Tobacco Control Country Profiles. We used actual 1995 population data because the bulk of the smoking surveys occurred closer to 1995 than to 1998. Our analyses attempted to estimate smoking prevalence by age category, information that has not previously been assessed at a global level.

METHODS

Population by Region, Sex, and Age Category

World Bank population figures by sex and age category for each of the World Bank's 7 regions (described on the World Bank's Web site, at http://www.worldbank.org/html/extdr/regions.htm) were used. Population figures for 1995 were used throughout the analysis.[10] We used World Bank regions rather than WHO or Global Burden of Disease regions[11] so as to provide results comparable to recent World Bank publications on tobacco.[12,13] Age categories (ages 15–19, 20–29, 30–39, 40–49, 50–59, ≥60) were chosen to coincide with the categories most commonly used in smoking prevalence studies.

Smoking Prevalence by Sex and Region

The results of 109 studies from the Tobacco Control Country Profiles[8] plus 11 from the literature[14–24] and 19 from the 1997 WHO[6] review were used to estimate smoking prevalence, by sex, for each of the 7 regions. The Tobacco Control Country Profiles methods have been described elsewhere.[8] For 19 countries, we chose prevalence as reported in the 1997 WHO publication, because these data were more recent.[6] Whenever possible, survey data that adhered to the WHO definitions of smoking[6] were selected so as to increase comparability between studies. The WHO guidelines state that respondents who report smoking at the time of the survey, or "current smokers," should be further categorized as "daily" (i.e., those who smoke at least once per day) or "occasional" smokers (i.e., those who smoke, but not every day). Although we used daily smoking as the prevalence indicator in our analyses, exclusion of 27 low- or middle-income countries that did not provide a definition of smoking only marginally changed the overall results.

We combined country-specific data to estimate regional prevalence values by weighting country estimates by the adult population (older than 15 years) of those countries. The resulting weighted average smoking prevalence rates are assumed to apply to the entire region, including those countries for which smoking prevalence is not known. When all of the sources were combined, data on smoking prevalence from individual studies were available for more than 96% of the population of each region, except eastern and central Europe and sub-Saharan Africa. For these 2 regions, data were available for 90% and 67% of the population, respectively. The median year of data for all countries was 1996.

Prevalence of Cigarette and *Bidi* Smoking in South Asia

In all regions with the exception of South Asia, cigarettes constitute the major form of smoked tobacco. In the countries of South Asia, however, many people smoke *bidis,* a hand-rolled cigarette. All calculations for South Asia were conducted separately for cigarettes and *bidis.* Data from 3 studies (2 from India[3,25] and 1 from Sri Lanka[6]) suggested that 47% to 51% of the male smokers and 52% to 95% of the female smokers smoke *bidis.* In this analysis, it is assumed that 50% of the male and 80% of the female smokers smoke *bidis,* with the remainder smoking cigarettes.

Smoking Prevalence by Age Category

We attempted to find 1 large-scale study of smoking prevalence by age category for each of the 7 regions (when possible, we used the most populous country in the region). China is used as the model country for East Asia and the Pacific,[23] Russia for Europe and central Asia,[15,26] Brazil for Latin America and the Caribbean,[27] Saudi Arabia for the Middle East and North Africa,[17] India for South Asia,[25,28] Sudan for sub-Saharan Africa,[24] and the United States for high income.[29] We validated the chosen studies, when possible, by substituting the age weights for various other countries in the same region and found little change (e.g., substituting Poland[30] and Hungary[31] for Russia, substituting Argentina and Chile for Brazil,[27] and substituting other high-income countries[32] for the United States). Ratios of smoking prevalence among older age categories compared with the 15- to 19-year age group were calculated. These ratios were applied to the entire region, including those countries for which the age ratios of smoking prevalence are not known.

RESULTS

Our estimates showed variations in smoking prevalence by region, sex, and age. Globally in 1995, 29% of the population aged 15 years and older, or 1.1 billion people, smoked daily (Table 1). Low- and middle-income countries, whose populations constitute four fifths of the global adult population, accounted for 82% of the world's smokers. East Asia and the Pacific, which includes China, accounted for 38% (429 million) of all smokers but only 32% of the population aged 15 years and older. Overall, smoking prevalence was highest in East Asia and the Pacific and in Europe and central Asia, at 34%, and lowest in sub-Saharan Africa, at 18%.

For both males and females, wide variations in smoking prevalence were found between regions. Smoking prevalence among males was highest in East Asia and the Pacific, at 62%, and lowest in sub-Saharan Africa, at 28%. Among females, the smoking prevalence was highest in Latin America, at 22%, and lowest in South Asia, at 4% (for cigarettes and *bidis* combined), and in the Middle East and North Africa, at 7%. Smoking prevalence was higher overall for men (47%) than for women (11%). Globally, males account for 81% of all smokers (Table 2).

Smoking prevalence was highest for persons aged 30 to 49 years (34%, Table 2) and lowest among youths aged 15 to 19 years (20%). It also was relatively low among people aged 60 and older (24%). The patterns of age-specific smoking prevalence were similar for males and females, although males had about a 4- to 5-fold higher prevalence in most age groups.

DISCUSSION

Our estimates have several limitations. First, in a few of the source reports, it was not possible to distinguish between daily smoking and occasional smoking. Thus, data from the studies were combined even when they may not have been strictly comparable. In our analyses, excluding or including countries with different definitions of smoking, such as regular smokers (occasional and daily) or daily smokers, did not greatly alter the regional and global estimates (results not shown). Variability in the rates of cigarette consumption, type of cigarette used and its tar levels, and duration of smoking are also key determinants of health outcomes that were not covered in our analyses. Second, although the overall and sex-specific smoking prevalence data are likely to be valid given that they were derived from direct studies in various countries, our indirect estimates of

TABLE 1—Estimated Smoking Prevalence, by Sex, and Number of Smokers Aged 15 Years and Older, by World Bank Region, 1995

World Bank Region	Smoking Prevalence, %			Total Smokers	
	Males	Females	Overall	No., Millions	% of All Smokers
East Asia and Pacific	62	5	34	429	38
Europe and Central Asia	53	16	34	122	11
Latin America and Caribbean	39	22	31	98	9
Middle East and North Africa	38	7	23	37	3
South Asia (cigarettes)	20	1	11	84	7
South Asia (*bidis*)	20	3	12	94	8
Sub-Saharan Africa	28	8	18	56	5
Low and middle income	49	8	29	919	82
High income	37	21	29	202	18
World	47	11	29	1121	100

TABLE 2—Global Prevalence of Smoking and Number of Smokers, by Age and Sex, 1995

	Males		Females		Total		
Age Categories, y	Prevalence, %	No. of Smokers, Millions	Prevalence, %	No. of Smokers, Millions	Prevalence, %	No. of Smokers, Millions	% of Total
15–19	34	89	6	16	20	105	9
20–29	42	213	10	49	26	262	23
30–39	56	229	12	48	34	277	25
40–49	56	175	12	36	34	211	19
50–59	51	108	12	25	32	133	12
≥60	40	99	12	35	24	133	12
Total	47	913	11	209	29	1121	100
% of Total	81		19		100		

age-specific patterns, which were based on 7 country-specific studies, are of uncertain validity. However, our age ratios were broadly consistent with ratios from the Tobacco Control Country Profiles adult smoking prevalence rates[9] and from a recent global survey of smoking among adolescents aged 13 to 15 years.[33]

These estimates are also consistent with the 1997 WHO analysis of smoking prevalence,[6] despite use of different data sources to estimate smoking prevalence for 1990, and with the Tobacco Control Country Profiles results,[9] despite different base years and regional categorization. The similarity across the 3 studies is consistent with agricultural data showing that overall tobacco production has remained constant through most of the 1990s.[34]

Some key points are noteworthy. Low- and middle-income countries have an aggregate smoking prevalence similar to that of high-income countries, but low- and middle-income countries account for the majority (82%) of the world's smokers. Males in low-income countries have a higher prevalence of daily smoking (49%) than do males in high-income countries (37%), whereas the reverse is true for females (8% in low-income countries and 21% in high-income countries).

Our analysis is consistent with predictions that total numbers and proportion of tobacco-attributable disease burden accounted for by low-income countries will increase dramatically in future decades. WHO estimated that in 1999, about 4 million tobacco deaths occurred worldwide. About half were in China, India, Latin America and other low- or middle-income countries outside Europe, and half were in high-income countries and former socialist economies of Europe.[6] Current tobacco mortality largely reflects past smoking. Per capita consumption has been higher in high-income countries than in low-income countries over the last few decades.[6] However, future tobacco mortality depends largely on current smoking patterns. Peto and Lopez[1] estimated, on the basis of current smoking patterns, that about 450 million cumulative tobacco deaths will have occurred by 2050, mostly in low-income countries. Similarly, Murray and Lopez,[35] using econometric models, estimated that 87% of the increase in tobacco-attributable deaths between 1990 and 2020 will occur in low-income countries. The increase in tobacco deaths is the result of both increases in the susceptible population size and increases in age-specific disease rates.

Also of importance in predicting future tobacco-attributable mortality is the prevalence of ex-smokers. Many of the future deaths expected among the 1995 cohort of smokers could be avoided if adults quit smoking. Much evidence indicates that smoking cessation reduces the risk of death from tobacco-related diseases. Among physicians in the United Kingdom, those who quit smoking before the onset of major disease avoided most of the excess hazard of smoking.[36] The benefits of quitting were largest in those who quit early (between ages 35 and 44) but were still significant in those who quit later (between

TABLE 3—Prevalence of Ex-Smokers at 2 Different Points in Time in Selected Countries, Stratified by Per Capita Gross Domestic Product

Country	Prevalence, % (Year)	Prevalence, % (Year)
High-income		
United States[38]	20 (1965)	30 (1991)
Australia[39,40]	28 (1986)	32 (1992)
Italy[41,42]	22 (1990)	28 (1995)
Sweden[43]	20 (1963)	41 (1994)
Spain[44]	17 (1989)	19 (1992)
Middle-income		
Hungary[31]	15 (1986)	14 (1994)
Poland[30]	18 (1974)	21 (1997)
Low-income		
China[23]	. . .	2 (1996)
India[3]	. . .	5 (1992–1994)
Vietnam[22]	. . .	10 (1997)

Note. Prevalence data for low-income countries for the earlier time period are not available.

ages 45 and 54 years). Similar analyses suggested that cessation before middle age avoids more than 90% of the lung cancer risk attributable to tobacco.[37]

Percentages of former smokers are the best measure of smoking cessation at a population level. In high-income countries, percentages of former smokers have increased over the past 2 to 3 decades, and today about 30% of the male population are former smokers (Table 3). In contrast, in recent years, male percentages of former smokers were only 10% in Vietnam,[22] 5% in India,[3] and 2% in China.[23] Even these low figures may be falsely elevated, because they include people who quit because of illness. Time trend data are not available for low- and middle-income countries.

We did not estimate smoking incidence, because systematic data on age-specific initiation rates are rarely available. In most high-income countries, about 8 of every 10 smokers begin smoking in their teens.[38] In middle- and low-income countries for which data are available, it appears that most smokers start by their early 20s, but the trend is toward younger ages.[12] For example, in China between 1984 and 1996, the number of young men (but not women) aged 15 to 19 years who began smoking increased significantly.[23] Incidence data are important for predicting longer-term trends in tobacco-attributable deaths and for monitoring the effectiveness of control policies aimed at preventing initiation. Because only those who start smoking in early adult life are at high risk of death from tobacco-related disease in middle and old age, there generally will be a delay of about half a century between the time of the main increase in smoking by young adults and the time of the main increase in death from tobacco-associated illness in later life. The implication of this time lag for control policies is that efforts to increase cessation among current smokers will yield the largest reductions in mortality over the next few decades.[1] ■

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Contributors

P. Jha and M.K. Ranson designed the study. P. Jha, M.K. Ranson, and S.N. Nguyen analyzed the data. All authors contributed to the writing of the article.

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